Reviews

Asian Journal of Surgery
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New Operative Strategies in Primary Hyperparathyroidism

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More than 95% of patients with primary hyperparathyroidism have been treated with bilateral neck exploration by experienced surgeons. This procedure has been performed without employing preoperative localization tests or specialized techniques of intraoperative measurement. A renewed interest in unilateral neck exploration for primary hyperparathyroidism emerged (in three developments), in an attempt to maintain the excellent cure rate and to minimize the invasiveness of the procedure. The first development was the introduction of sestamibi scintigrams as a new preoperative localization technique and intraoperative nuclear mapping with a hand-held gamma probe. The localization of adenomas using this technique was much more accurate than that of previous localization studies, allowing unilateral procedures to become feasible. Sestamibi guidance enables parathyroidectomies to be performed much more rapidly through a significantly less invasive dissection. Secondly, the intraoperative quick parathyroid hormone assay allows the confirmation of removal of the parathyroid mass. The third development was endoscopic parathyroidectomy. Various approaches have been shown to be technically feasible, including endoscopic procedures that rely on CO_2 insufflation to create a working space or video-assisted procedures in which the working space is maintained through conventional external retraction. Given the safety and high success rate of the standard exploration, the potential advantages of these new strategies include decreased operating time, local or regional anaesthesia rather then general anaesthesia, and smaller incisions. (*Asian J Surg* 2002;25(2):184–7)

Primary hyperparathyroidism may have a heterogenous aetiology and pathogenesis, and the optional therapy must be individualized for patients[1] with the following: 1) single-gland disease (adenoma), 2) hyperplasia of four or more glands, 3) double adenoma, 4) carcinoma, 5) microadenoma, 6) disrupted parathyroid syndrome, and 7) normal pathology.

The best surgical strategy enables the primary hyperparathyroidism to be resolved with minimal complications,[2] such as persistent hyperparathyroidism, recurrent hyperparathyroidism, postoperative hypoparathyroidism, and recurrent laryngeal nerve injury. The surgical strategy must also minimize the length and region of incision, extent of exploration, cost and length of hospital stay, while maintaining an excellent outcome.

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Date of acceptance: 15th June 2001

The success rate for parathyroidectomies performed by experienced endocrine surgeons is 95% or better.[3,4] Persistent hyperparathyroidism is usually the result of missing either an ectopic tumour or one of multiple abnormal glands. Recurrent hyperparathyroidism usually occurs in patients with familial disease, such as those with familial isolated hyperparathyroidism and multiple endocrine neoplasia (MEN) 1. Until recently, an argument existed as to whether unilateral or bilateral neck exploration was preferable for primary hyperparathyroidism. Surgeons who advocated bilateral neck exploration believed that it should be the standard approach because it is safe and greatly reduces the chances of missing a second adenoma. Innovations such as the intraoperative quick parathyroid hormone (PTH) assay and sestamibi scintigraphy have allowed the development of radioguided, endoscopic parathyroidectomies, which are both minimally invasive and precise. Several investigators have reported high success rates using these techniques,

with reductions in incision length, operation time, and length of hospital stay.

Unilateral Neck Exploration

The success of bilateral neck explorations with or without the biopsy of normal-looking glands depends on the surgeon's ability to differentiate between normal and abnormal glands on the basis of size. In experienced hands, this approach results in a 90% to 98% success rate with low morbidity.[5] Some surgeons have performed unilateral neck exploration if only one enlarged gland and an ipsilateral gland of normal size were found.[6] Experienced endocrine surgeons have reported excellent results using this limited surgical approach. In the 1990s, the availability of sestamibi and ultrasonography (US) greatly facilitated surgical policies regarding unilateral neck exploration.[7,8] In 1995 and 1996, the author performed unilateral neck exploration in all 33 of his patients with solitary parathyroid adenomas.[8] Double-phase MIBI-99m Tc subtraction scintigraphy, alone or with single photon emission computed tomography, was performed in combination with US in each case.[9] The sensitivity of the MIBI scintigraphy and US were 92% and 86%, respectively. All of the patients were successfully treated using a unilateral approach except for two patients in whom a solitary adenoma was detected in the mediastinum. The average operating time, excluding the two cases requiring a mediastinectomy, was 41 minutes. No complication occurred in any of the patients. Although the surgical success rate is influenced by the length of the follow-up period, the success rate in this group, to date, is 100%. Thanks to techniques that allow proper localization, the unilateral approach for patients with primary hyperparathyroidism is less invasive, associated with fewer complications, and can be tolerated by most patients with primary hyperparathyroidism.[10] For patients at high risk, such as those with respiratory or cardiovascular diseases, unilateral exploration under local anaesthesia is a useful method of treatment. A retrospective study found no differences in the surgical outcome between unilateral exploration and bilateral exploration.[2] One might, thus, argue that unilateral exploration is, at the very least, not worse than bilateral exploration. The frequency of persistent hyperparathyroidism was 5% higher for unilateral exploration than that for bilateral exploration. Since a prospective, controlled study has not been performed, the argument for or against unilateral neck exploration remains theoretical.

Minimally Invasive Parathyroidectomy

Sestamibi scintigraphy is a new technique that enables the accurate localization of parathyroid adenomas. Using this modality, a new procedure known as radio-guided parathyroidectomy has been developed.[11] The combintaion of this procedure with the use of the intraoperative quick PTH, which provides biochemical confirmation that the adenomas have been completely excised, could revolutionize the new approach for parathyroidectomies.[12] In addition, the development of endoscopic parathyroidectomies has also been an evolutionary change in surgical procedures for parathyroidectomies.[13–15]

The recent development of radio-guided parathyroidectomy has allowed parathyroidectomies to be quickly performed using a significantly less invasive procedure.[11] Radio-guided parathyroidectomy is also likely to decrease the risk of nerve injury because of the minimal amount of dissection required and the directed nature of the technique. A smaller operative region is also likely to be associated with a smaller risk of hematoma formation and a reduced need for drainage. Although radio-guided parathyroidectomy is a viable alternative to standard surgery for properly selected hyperparathyroid patients with no history of exploratory procedures in the neck region, it is also extremely useful in patients with hyperparathyroidism who have undergone previous neck exploratory procedures. The advantages of this procedure include a smaller incision, a shorter operation time, a decreased risk of complications, discharge from the hospital two hours after surgery, the near-elimination of the need for frozen section histological analysis, and a less complicated preoperative work-up.

Irvin et al have developed a quick assay for determining PTH levels.[12] The assay can be used intraoperatively during neck exploration. Several recent reports have confirmed the accuracy and utility of this approach.[13] The quick PTH assay is commonly performed by obtaining a baseline PTH level and then testing the PTH levels at 5 and 10 minutes after the resection of the putative parathyroid tissue. A 50% decrease in the PTH level measured 5 minutes after removal of the parathyroid tissue is indicative of a cure.[12] Weber and Ritchie reported that intraoperative PTH monitoring can accurately predict the outcome of parathyroid surgery in patients with solitary adenomas,[16] but that this assay may underestimate the extent of resection required in patients with parathyroid hyperplasia.

When compared to parathyroidectomies guided by the appearance of abnormal parathyroid gland morphology, the intraoperative quick PTH assay can accurately predict the disease state in 89% of patients.[17] In addition to a shorter operating time and associated morbidity, directed parathyroidectomy also has the potential to realize significant cost reductions. The intraoperative PTH assay may be particularly useful in complicated cases and in patients undergoing a second operation. This test does, however, have some limitations and should not be used as a substitute for a thorough knowledge of the wide spectrum of potential findings that can occur during operations for hyperparathyroidism.[18] To evaluate the possible risk of recurrent or persistent hyperparathyroidism in cases of false-positive results, further studies are necessary.

During the last three years, several minimally invasive parathyroidectomy procedures have been developed for the treatment of hyperparathyroidism. They range from the "pure" endoscopic approach (completely closed technique)[19–21] characterized by a constant gas insufflation, to "video-assisted gasless" techniques[22] and minimally invasive "open" parathyroidectomies guided either by intraoperative radioisotopes[11] or relying on preoperative localization studies.[23] The presently reported procedure can be classified as a minimal-access surgery and provides both a better cosmetic scar and a less painful postoperative course. Its disadvantages include a longer operating time, a supposedly higher cost, and the possible risk of missing multiglandular disease. Initial reports on endoscopic and video-assisted unilateral parathyroidectomies state that these procedures are useful in cases of localized single gland disease with no evidence of nodular goitre or history of prior neck exploration.[23] Endoscopic and video-assisted techniques are, thus, highly feasible. Inaccurate localization, limited working space, larger parathyroid adenomas, nodular goitre or prior thyroid surgery complicate or eliminate the usefulness of these new techniques. Our successful use of video-assisted parathyroidectomies using gas insufflation to perform bilateral parathyroidectomies and subtotal thyroidectomies led us to reconsider our strategy for operating on thyroid lesions and multiple parathyroid masses (Figures 1, 2). Thus, we developed a new technique involving the performance of an endoscopic parathyroidectomy from an axillary approach, with no scarring of the neck or anterior chest wall. In this approach, three trocars are inserted from the axilla, allowing neck incisions to be avoided.[20] The small scar left in the axilla is completely covered by the patient's arm when the arm is in a natural position.[21,24] The cosmetic results are excellent. Sufficient separation from the axilla to the neck is easily achieved by gradual CO_2 insufflation. The small working space that is created by maintaining CO_2 insufflation at below 4 mmHg reduces the risk for hypercapnia and subcutaneous emphysema. Hyperaesthesia and paraesthesia of the neck are also negligible because of the small subplatysmal space. Some of the limitations of exposure, visualization, dissection, and haemostasis that presently confound the endoscopic approach should be overcome by further technological advances in minimally invasive

Figure 1. After making a 5-mm median skin incision for insertion of a laparoscope, two additional 5-mm trocars are inserted into the subcutaneous tissue about 5 cm below the inferior border of the ipsilateral clavicle. The specimen is placed in a finger of a plastic glove, and extracted through the 5-mm skin incision.

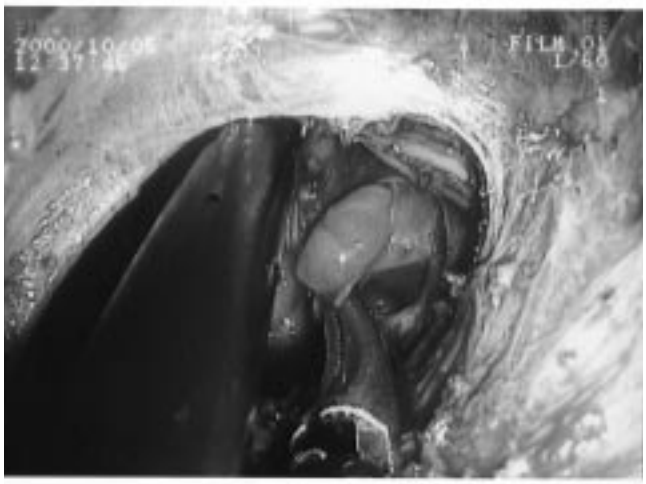

Figure 2. The right inferior parathyroid adenoma is protruded to separate the thymus tissue and dissected with endoscopic scissors.

instrumentation.[25] Although the merits and disadvantages of endoscopic or video-assisted parathyroidectomy and radio-guided parathyroidectomy must be evaluated on a broader scale, it is likely that minimally invasive techniques for neck exploration and parathyroidectomy will play an increasingly important role in the management of patients with hyperparathyroidism.

The new technique introduced here is apt to lead to shorter hospital stays in a select group of patients, as this operative procedure may be performed on an outpatient basis. Due to the different insurance systems internationally, information on the length of overall hospital stay is not comparable between countries.

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